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Technology, Progress and Risk

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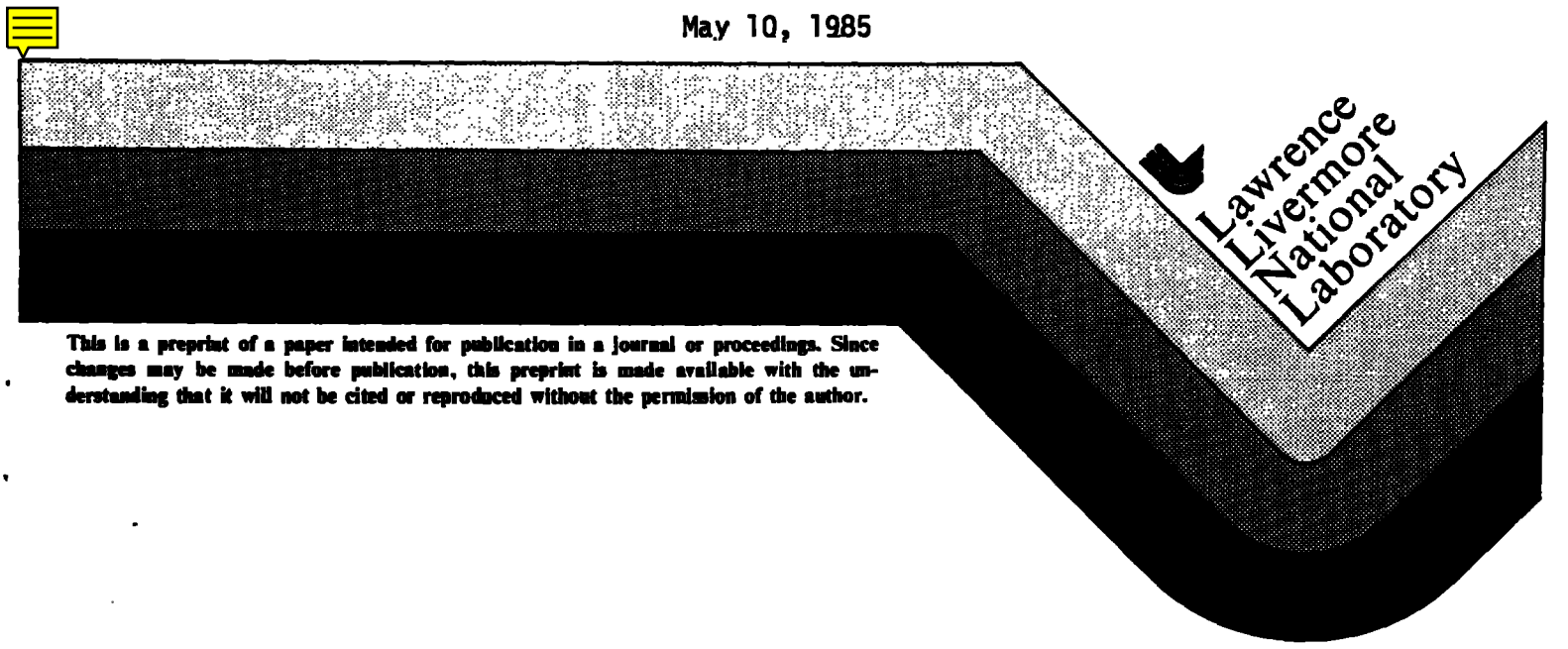

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TECHNOLOGY, PROGRESS & RISK

Advances in technology and the progress of society have historically gone hand in hand; however, it's human nature to resist and even fear the changes that come with progress. Concern for the effects of change and the risks associated with the introduction of new technologies drives the regulatory process and supports a constituency that derives its livelihood from these concerns.

The use of the atomic bomb against Japan has indelibly engraved the "mushroom" cloud in the minds of Americans. Also, for the past forty years fiction writers and movie makers have used radiation, fallout, and other nuclear effects to explain the creation of giant insects, the Blob, the Creature from the Deep Lagoon, the 50 foot Woman, and other assorted and mostly evil monsters. Also innumerable aliens from outer space have appeared to save us from ourselves after they discovered we were playing with nuclear energy. A generation grew up subjected to this programming, and as a consequence, today, many people are firmly convinced that nuclear power is too risky to pursue.

Also we have "grant gatherers." If you are doing research in a university or independent research organization, one of the ways you can get a grant is to claim that cranberries cause cancer or that milk contributes to heart disease, or public buildings are not safe in the event of an earthquake, and that it is imperative that a further study be made. As an example, with nearly 45,000 toxic farm chemicals in use, and with concern over the effects of pesticides, herbicides, and livestock hormones intensifying, there is fertile ground for research, and, just think, only 10% have had a thorough health hazard assessment. Remember the EDB scare a few years ago? The costs associated with removing this chemical from the country's grain and bake mix inventory were considerable.

And there is the media. What can I say about the media? As a child I remember asking my mother when I was going to die. She told me that I wouldn't die until after I ate a peck of dirt, and that's why I should wash my hands, so it would take longer. How simple life seemed then. Now, I find that not only is some dirt worse that other dirt, but there are all those other things out there trying to get me. Hardly a day goes by without an article in the paper claiming that either this or that is dangerous to life.

Last but not least, we must remember that some people are afraid of nearly everything, and they write letters too. As Congressman Donald Ritter says, "Politicians are over regulating industry based on fears and not on an understanding of technology."

Rational public policy decisions are politically difficult when public perception of risk is very different from reality and where costs and benefits of a new technology don't come together in time, and when those that get the benefits don't pay the costs. This gap in public perception between risk and actual risk and the disconnect between costs and benefits have at least two major effects. One, it allows many activities of considerable risk to continue too long without proper attention. Toxic wastes disposal, and acid rain, smoking could be taken as a few examples. Two, it makes it virtually impossible to site controversial new facilities such as those for: LNG storage, garbage disposal, refuse concentration, or toxic waste disposal. If you can't site affordable housing in your community, how could you site a nuclear reactor?

Public perception of risks, costs, and benefits drives the environmental movement and the political process which in turn result in litigation , injunctions, mandated studies, and rules and regulations all aimed at achieving a level of acceptable risk to the public. It's well to remember that acceptable risk is that level of risk that is OK for you but not for me. It is an emotional subject when it's close to home. I will always

remember the vivid images that came to mind when I read about the reactions of a group of young mothers at the public hearings on the proposed standards for acceptable levels of rat droppings in baby food. Acceptable risk is a moving target, and what is acceptable today is not acceptable tomorrow.

I believe, as engineers we must not sit around playing "ain't it awful" while waiting for everyone else to get educated so they'll see things like we do (this implies that we all agree). It won't change. The pace of new technology introduction has never been faster, and it is increasing. There is ever more concern by the public for the societal impact of new technology. Acceptable risk will continue to be elusive.

Engineers are being held increasingly responsible for their actions due to their professional status in their community. Engineers are accused of being both judge and jury when working on projects that expose workers or the public to risk. Risks will be judged to be reasonable or unreasonable not by the engineer's peers, as in the past, but by the courts, and this judgement will be <u>after the fact</u>. Like it or not, the successful engineer has become a "deep pocket" target.

Engineers will need to keep up to date technically and stay in touch with current societal and regulatory expectations regarding risk. This is a tremendous challenge as the increasingly multi-disciplinary nature of our activities will require each of us to gather, assimilate, and apply a great deal of technical information in making our decisions. OSHA, for example, does not define "feasible" or "practicable" as they are meant to be moving targets. Consequently, when an engineer prepares a cost/benefit analysis, he must be sure that it reflects the <u>currently</u> acceptable meaning of feasible.

Consider asbestos removal from your office building. Should you ignore it because the airborne fiber concentration is within acceptable limits? Will the limits change? Should you seal it

or enclose it away from the circulating air? Should you have it removed, gambling that the contractor will get it all and not spread it throughout your building only to have it be resuspended by the air conditioning system? Your decision could result in costly litigation, or possible abandonment of the building. I read in the Wall Street Journal the other day that the pollution liability insurance field has collapsed because of 50% to 200% rate increases. Many asbestos removal companies can no longer get liability insurance and they are going out of business. How does this influence your decision? Union Carbide said it's having trouble getting the liability insurance that it had last year. How will this affect their business plan?

Each of us has an opinion on which of the new or emerging technologies will have the most impact on the regulatory environment in the next few years. Some at the top of my list are:

Advances in molecular mutagenesis and flow cytometry will allow for rapid, less expensive assessment of the mutagenic effect of trace amounts of chemicals that we are exposed to in our offices, homes, the air we breathe, and the food we eat. The list of toxic substances will continue to grow and change each year and so will the regulations.

Artificial intelligence systems coupled with high resolution spectrometers will increase our ability to detect and identify in our environment the low level, stable, and accumulating decomposition products of common materials and products. For example, rubber dust from tire wear is bio-degradable except for one trace impurity in a common vulcanizing chemical. The level of this impurity appears to be building up in the San Francisco bay waters. We will hear more about these long lived chemicals and their removal from industrial products.

The availability of inexpensive, remote, fiber-optic fluorescence detectors will lead to regulations requiring in-situ monitoring of trace chemicals in ground water and in injection wells.

Regional atmospheric release advisory systems like those developed to track and predict the path of radioactive plumes from nuclear accidents will be used to pinpoint chemical releases which some now believe to be much larger than the public realizes. This may allow the principal sources of acid rain to be identified.

New computer aided design, analysis, and engineering tools will allow for a new standard of reliability and performance against which all products will be judged . (2.8% of engineers/architects are currently using these tools.) Also, new risk analysis algorithms that handle very large fault trees and digraphs are becoming available, and the pressure to apply them will increase independent of their validity.

The ready availability of information from libraries and data bases on current regulations and standards will create a higher standard of accountability and oversight.

With the easy access to scientific and technical data banks, engineers will be expected to examine broad interdisciplinary aspects and impacts of their activities.

In closing, I would leave you with one thought for the future, and that is that Engineers will need to have global knowledge at design time because that's what they will be held ever more accountable for at trial time.

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